

# Disruption Tolerant Networking

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**DARPA Strategic Technology Office (STO)**



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# **Project Data (internal use only)**

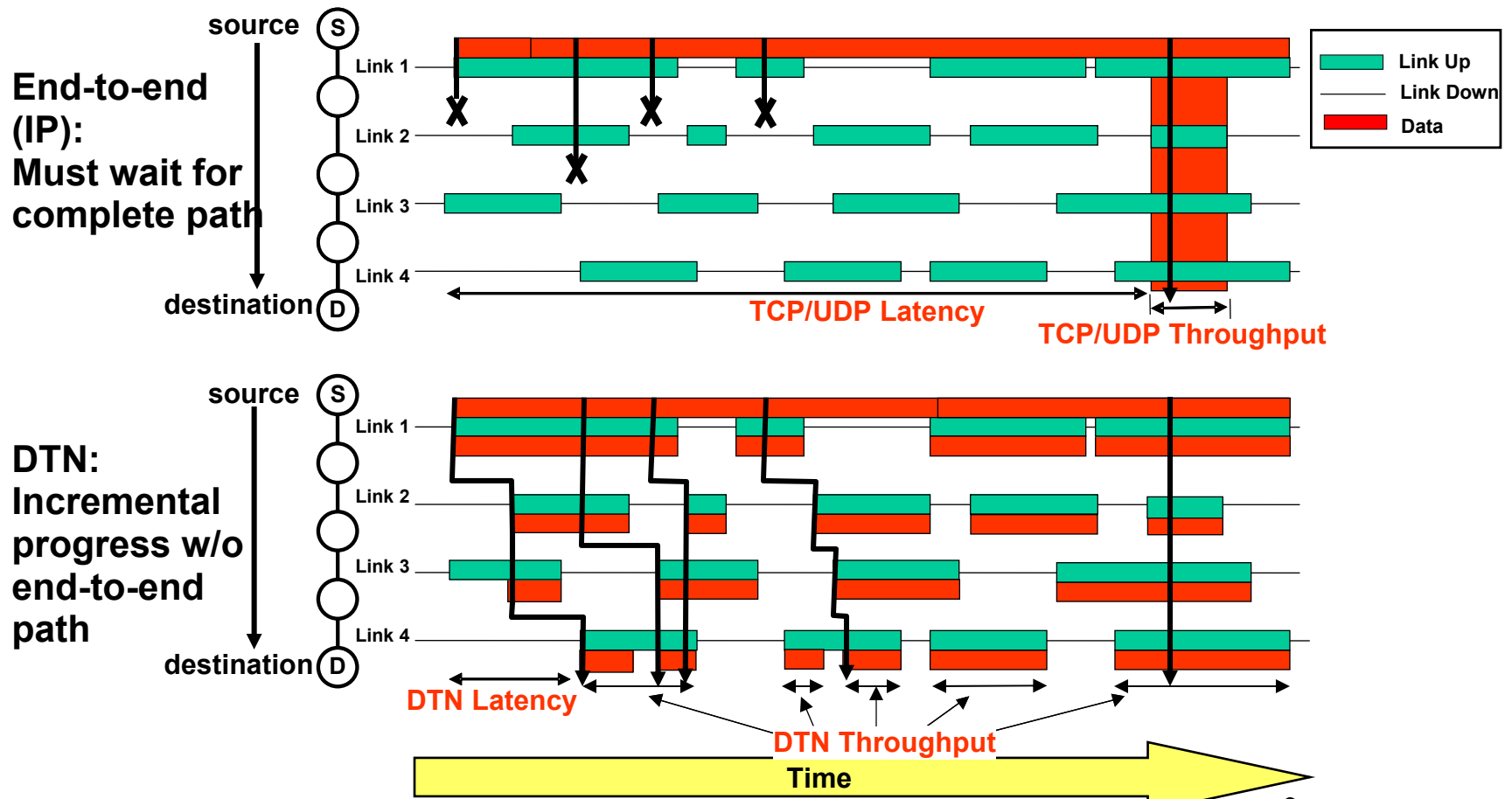
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# Problem

- **Network-centric warfare depends heavily on Internet protocols**
  - **These work well with short delays, low error rates, and continuous connectivity**
  - **Military environments can have disrupted connectivity, long/variable delays, high error rates, extreme heterogeneity**
- **How to design a communications architecture that spans “connected” and “disrupted” environments, working well in both**

# Background



***DTN Can Reduce Delay and Increase Throughput***



# Objective

- **Design a secure and robust Disruption Tolerant Networking (DTN) architecture and protocols to support networking in extreme environments**
- **Mature specifications toward RFC status**
- **Enhance protocols for military applications**
- **Foster early adoption by services**
- **Integrate with tactical systems and applications**

# Activities

## DTN Network Persistence Can Solve Fundamental Internet Application Shortfalls

Right information... Right place... Right time

- DTN makes applications over disrupted networks robust
- DTN is also an *Opportunity* to solve *Fundamental Problems* we've never before had a handle on, using *Network-Managed Persistence*
  - Access information by content or type rather than by network address
    - “I want maps for my area” instead of “I want to ftp to 192.168.4.17”
  - Retrieve once, provide to local users as requested
  - Learn from actual network usage
  - Exploit in-network storage/caches and pub/sub protocols to create a dynamic and self-forming “Akamai”
  - Use *temporal* security rather than *physical* security

### Integrated Push-Pull

• Good overall  
• Subsequent requests build “akamai”

Nth request gets data from local DTN cache with minimal delay

### Resource Utilization

Subsequent requests for same data receive copies already cached in the network – only one copy of the data ever crosses any given link.

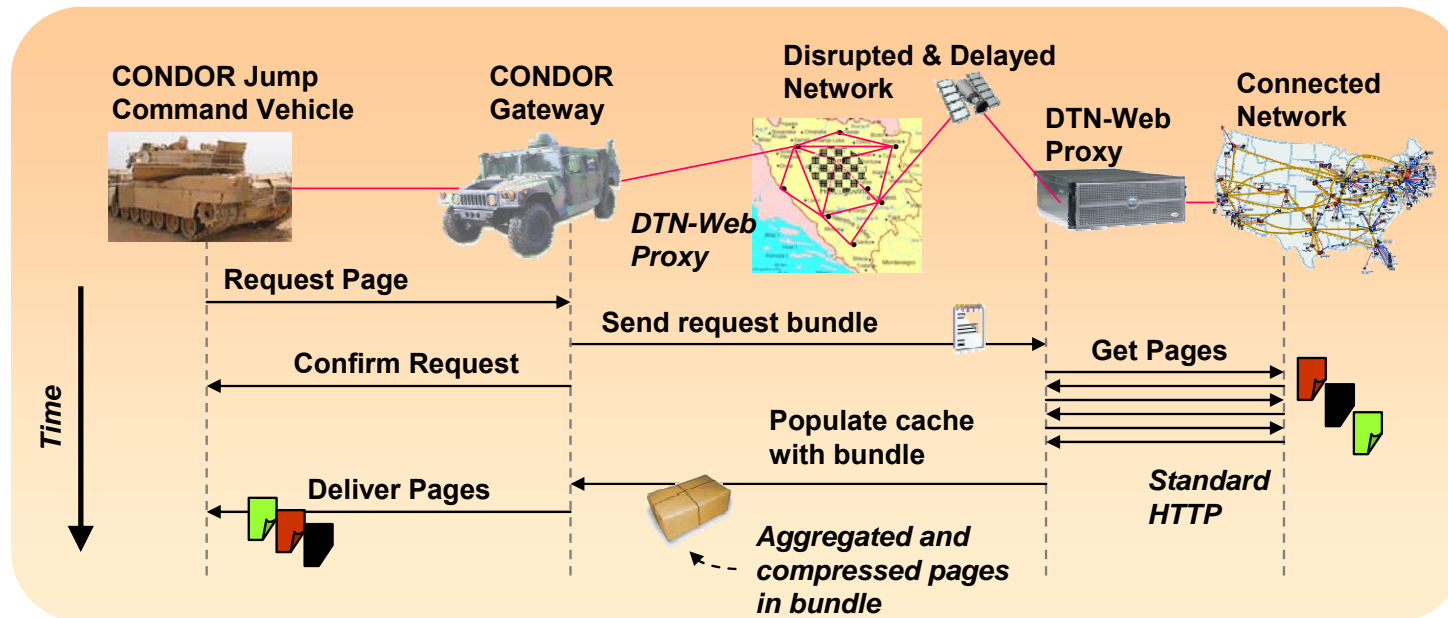
### Temporal Security Model

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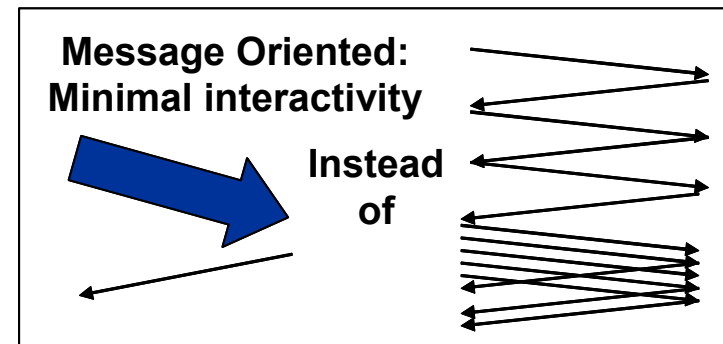
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# Highlight: DTN-Web Proxy



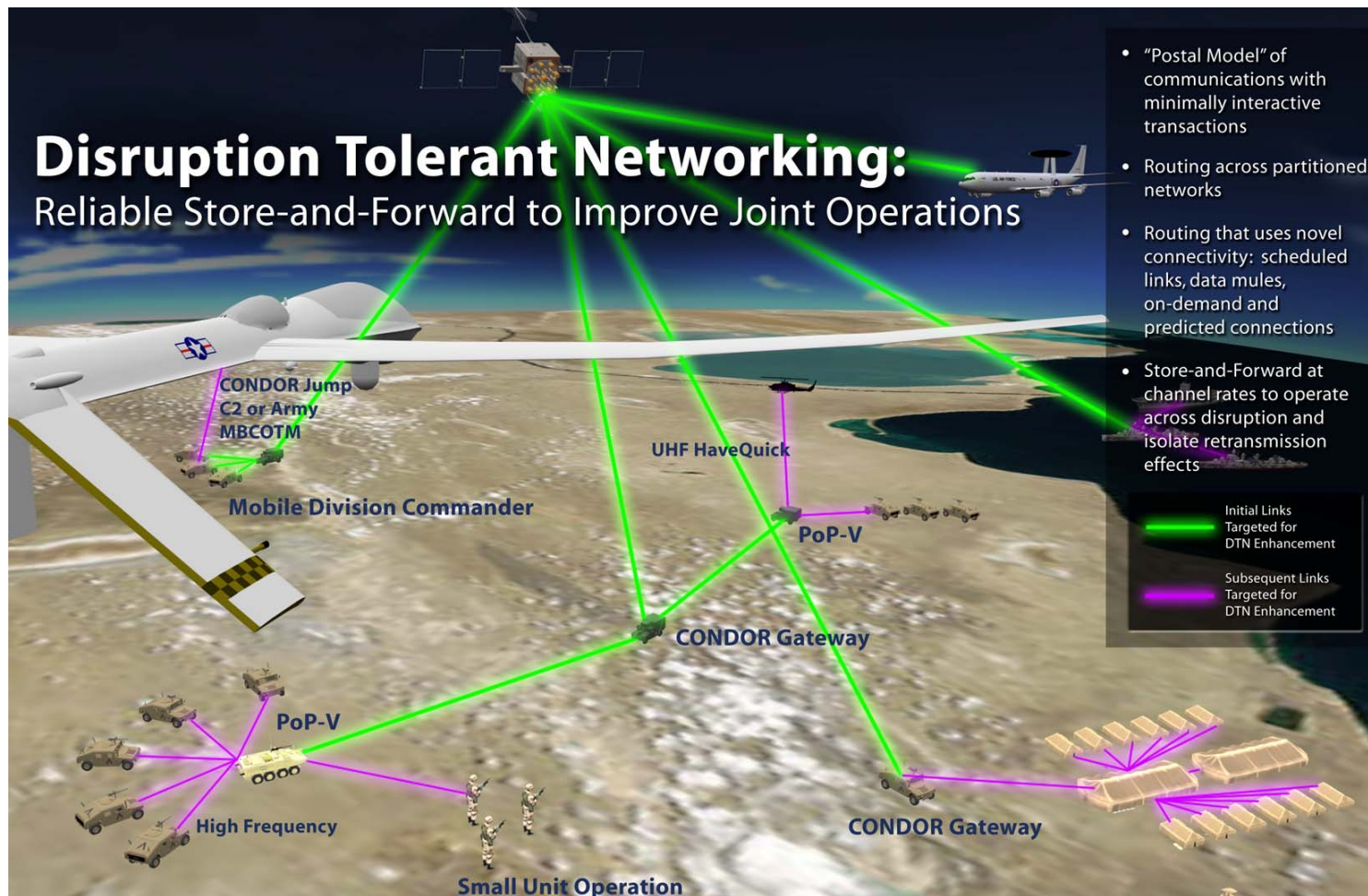
- **Routing Across Network Disruption Using**
  - On-demand connections
  - Scheduled connections
  - Predicted connections
  - Opportunistic (unexpected) connections







# Highlight: DTN-for-CONDOR





# Impacts

- Enable the vision for secure and reliable communications for “distributed ops”
- Provide support for *practical* mobile ad hoc networks in tactical environments
- Improve network and application performance in disrupted tactical environments
  - Higher throughput and utilization over challenged connections
  - Connectivity to lower echelons using tactical radios



# Future Plans

